Financial Performance Evaluation of Energy Enterprises from Low Carbon Perspective

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Abstract. In the context of low-carbon economy, it is the responsibility and mission of energy-based enterprises to develop new energy products, improve technical standards, reduce carbon emissions, and reduce energy consumption. In the traditional financial evaluation indicators, the carbon emission indicators have not been included in the financial performance evaluation system of the enterprise, thus ignoring the environmental impact of the development and operation of energy-based enterprises. Therefore, in this paper, based on the financial performance evaluation system of innovative energy-based enterprises, the author incorporates carbon emission efficiency into the original evaluation index system, and uses fuzzy comprehensive evaluation method to build a financial performance evaluation model for energy-based enterprises. Determine the weight of each indicator and reasonably evaluate the comprehensive performance of energy companies.

1. Introduction

With the evolution of China's long-term extensive growth mode, the rapid development of industrialization and urbanization and the contradiction between energy resources and ecological environment are increasingly apparent. The global warming caused by the rapid growth of greenhouse gases is gradually eroding the development of social economy. In recent years, the international community has proposed a series of countermeasures against environmental issues. From the long-term goal of global greenhouse gas emissions put forward at the G8 summit in Tokyo [1], Japan in July 2008, by the Copenhagen Global Climate Conference in February 2009 [2], countries around the world have reached consensus on environmental protection and the development of a low-carbon economy. At the conference, the Chinese government promised to reduce carbon dioxide emissions per unit of GDP by 40% to 46% in 2020, and prepare to formulate corresponding domestic statistics, monitoring and assessment methods, and incorporate emission reduction targets as binding indicators into the national economy. And medium and long-term planning for social development [3].

As an important microeconomic activity subject, enterprises are the key link to achieve low-carbon economic development. The arrival of a low-carbon economy will lead to changes in various macro financial environments to varying degrees, and these environmental changes will have an impact on corporate finance, and companies must adjust their finances to adapt to new economic development patterns. Under the low-carbon economy, as an energy-based enterprise, it is necessary to re-examine the original financial activities and evaluation methods, monitor environmental protection issues from a financial perspective, and design an indicator system that is consistent with a low-carbon economy. Therefore, based on the existing theory of financial analysis and evaluation index system, this paper will formulate a scientific and practical financial evaluation index system according to the requirements of

low-carbon economy, and adopt appropriate methods to comprehensively evaluate the financial performance of low-carbon economic enterprises.

2. Construction of cost-benefit analysis and evaluation index system for enterprise carbon emissions

Considering the low carbon target constraint of social environment and the special nature of energy enterprise, this paper builds a financial performance evaluation system of energy enterprise integrating economic interests, social interests and environmental benefits based on low carbon perspective, and adopts analytic hierarchy process and entropy value [4]. The fuzzy comprehensive evaluation method of the law conducts empirical research and designs five categories of indicators including profitability, solvency, operational capability, development capability and low carbon capacity, and incorporates some representative low-carbon performance indicators directly into the traditional in the financial indicators, and based on this, the fifth major indicator, the low-carbon capacity indicator, is added to meet the needs of the internal and external evaluation of the company's low-carbon operation status and effectiveness, and to achieve sustainable development of the enterprise. The indicator system is shown in Table 1.

Table 1. Three-dimensional financial performance indicator system for energy companies

Target layer	Criteria layer	Indicator layer	Indicator description
Enterprise Financial Comprehensive Evaluation Index System (A)	Profitability (B1)	Return on total assets (B11)	Profit before interest and taxes / average total assets × 100%
		Return on equity (B12)	Net profit / average net assets × 100%
		Sales profit margin (B13)	Net profit / operating income × 100%
	Solvency (B2)	Quick ratio (B21)	(current assets - inventory) / current liabilities × 100%
		Asset-liability ratio (B22)	Total liabilities / total assets × 100%
		Interest coverage multiple (B23)	EBIT/interest expense
	Operational capability (B3)	Accounts Receivable Turnover Rate (B31)	Credit sales / average accounts receivable
		Inventory turnover rate (B32)	Operating cost / average inventory
		Total asset turnover (B33)	Net operating income / average total assets × 100%
	Development capacity (B4)	Sales growth rate (B41)	(current operating income - previous operating income) / previous sales revenue × 100%
		Capital accumulation rate (B42)	(current owner's equity - previous owner's equity) / previous owner's equity × 100%
		Total asset growth rate (B43)	(Total assets in the current period - total assets in the previous period) / Total assets in the previous period × 100%
	Low carbon capacity (B5)	Unit revenue waste (B51)	Enterprise “three wastes” emissions / main business income × 100%
		Unit income energy consumption (B52)	Enterprise energy consumption / main business income × 100%
		Low carbon equipment investment ratio (B53)	Low carbon equipment net worth / fixed assets net value × 100%

2.1. Analytic hierarchy process to determine indicator weights

Assuming that the element *B* of the previous layer is used as a criterion, it has a dominant relationship with the elements *B1, B2, Bn* of the next level. The establishment of the judgment matrix is to assign the corresponding weights of *B1, B2, Bn* according to their relative importance under criterion *B*, that is, to repeatedly weigh the importance of criterion *B*, the two elements *B1* and *B2*, and here we need to use the 9-point ratio [5]. The scale assigns importance to importance. If the factor *i* is compared with *j* by a_{ij}, the factor *j* is compared with *i* and judged as $1/a_{ij}$. The consistency test is performed on the evaluation results using the formula (1), and the formula is as follows.

$$CI = \frac{\lambda_{\max} - n}{n-1} \tag{1}$$

Then determine the indicator weights, there are formulas as follows.

$$\overline{w}_i = n\sqrt{\prod_{j=1}^{n} a_{ij}} \qquad (i = 1,2,3...,n) \tag{2}$$

Then, the normalized judgment matrices are added by columns according to formula (3), and then the entire column vector is normalized to obtain the normalized relative importance of the elements relative to the upper layer criterion.

$$w_i = \frac{\overline{w}_i}{\sum_{i=1}^{n} \overline{w}_i} \qquad (i = 1,2,3...,n) \tag{3}$$

Calculate the weight of each dimension of the criteria layer relative to financial performance, and obtain Table 2.

Table 2. Energy Enterprise Judgment Matrix and Weights of Energy Enterprises

A	B1	B2	B3	B4	B5	W
B1	1	1/2	1/2	4	2	0.20
B2	2	1	3	1/2	2	0.35
B3	2	1/3	1	4	1/2	0.16
B4	4	2	1/4	1	1/3	0.12
B5	1/2	1/2	2	3	1	0.17

Consistency test results: *lmax* = 6.329; *CI* = 0.0658; *RI* = 1.24; *CR* = 0.0531 < 0.1.

By analogy, the secondary indicators can be used to derive the weight of each level of indicators relative to the upper level indicators. The weights of each level of the financial evaluation system are as follows.

Table 3. Analytic hierarchy process to determine the weight of each indicator

Target layer	Criteria layer	Weights	Indicator layer	Weights
Enterprise Financial Comprehensive Evaluation Index System (A)	Profitability (B1)	0.20	Return on total assets (B11)	0.450
			Return on equity (B12)	0.275
			Sales profit margin (B13)	0.275
	Solvency (B2)	0.35	Quick ratio (B21)	0.330
			Asset-liability ratio (B22)	0.452
			Interest coverage multiple (B23)	0.218
	Operational capability (B3)	0.16	Accounts Receivable Turnover Rate (B31)	0.370
			Inventory turnover rate (B32)	0.357
			Total asset turnover (B33)	0.273
	Development capacity (B4)	0.12	Sales growth rate (B41)	0.440
			Capital accumulation rate (B42)	0.358
			Total asset growth rate (B43)	0.202
	Low carbon capacity (B5)	0.17	Unit revenue waste (B51)	0.355
			Unit income energy consumption (B52)	0.259
			Low carbon equipment investment ratio (B53)	0.386

2.2. Entropy method to determine the index weight.

(1) Raw data standardization processing. Converted as follows:

$$x_{ij} = \frac{\max\limits_{i}\left\{a_{ij}\right\} - a_{ij}}{\max\limits_{i}\left\{a_{ij}\right\} - \min\limits_{i}\left\{a_{ij}\right\}} \qquad \left(i = 1,2,3...,n\right) \tag{4}$$

In the formula, $\max\limits_{i}\left\{a_{ij}\right\}$ and $\min\limits_{i}\left\{a_{ij}\right\}$ respectively represent the maximum value and the minimum value among all the evaluation objects under the same indicator.

(2) Calculate the characteristic weight of the i-th evaluated object under the j-th index.

$$P_{ij} = \frac{x_{ij}}{\sum\limits_{i=1}^{n} x_{ij}} \qquad \left(i = 1,2,3...,n\right) \tag{5}$$

(3) Calculate the entropy value A of the j-th index, with the expression:

$$e_j = -\left(\ln n\right)^{-1} \sum_{i=1}^{m} p_{ij} \ln p_{ij} \tag{6}$$

If $p_{ij}=0$, define $\lim_{p\to 0} p_{ij}\ln p_{ij}=0$. If x_{ij} is equal for a given j, then $p_{ij}=1/n$, then $e_j=1$. Where n is the number of objects to be evaluated and m is the number of indicators.

(4) Calculate the difference coefficient of index x_j. The greater the difference coefficient $q_j=1-e_j$, q_j more attention should be paid to the role of this indicator.

(5) Determine the weight. Using the entropy value to calculate the objective weighting expression of each indicator is:

$$w_j = q_j / \sum_{j=0}^{m} q_j \qquad (j=0,1,2...,m) \tag{7}$$

According to the above steps, the weights of each indicator under each dimension of the enterprise financial comprehensive evaluation index system are obtained, as shown in Table 4.

Table 4. Fuzzy comprehensive index weights determined by entropy determination method

Profitability (B1) 0.325			Solvency (B2) 0.112			Operational capacity (B3) 0.225			Development capacity (B4) 0.158			Low carbon capacity (B5) 0.180		
B11	B12	B13	B21	B22	B23	B31	B32	B33	B41	B42	B43	B51	B52	B53
0.310	0.425	0.265	0.352	0.245	0.403	0.514	0.253	0.233	0.512	0.210	0.278	0.335	0.289	0.376

2.3. Comprehensive weight determination

The weights obtained by the analytic hierarchy process belong to subjective weights, and the weights obtained by the entropy method belong to objective weights. In order to make the weights of each indicator more scientific and reasonable, this paper will combine the above two methods to determine the weight of indicators in each dimension and each dimension layer, as shown in Table 5.

Table 5. Fuzzy comprehensive index weights determined by entropy determination method

Profitability (B1) 0.2625			Solvency (B2) 0.231			Operational capacity (B3) 0.1925			Development capacity (B4) 0.139			Low carbon capacity (B5) 0.175		
B11	B12	B13	B21	B22	B23	B31	B32	B33	B41	B42	B43	B51	B52	B53
0.380	0.350	0.270	0.341	0.349	0.311	0.442	0.305	0.253	0.476	0.284	0.240	0.345	0.274	0.381

3. Discussion of results

Overall financial performance is generally low. Under the traditional financial performance evaluation system, enterprises generally do not pay attention to social interests and environmental interests, resulting in lower scores in these two dimensions. The author believes that energy companies should pay attention to the commitment of social responsibility and the strengthening of environmental awareness. In the use and distribution of assets, increase the contribution of social contribution and energy conservation and emission reduction. Although these measures cannot achieve immediate results, they are in line with the trend of the times. It can establish the reputation of the company and realize the sustainable development of the company [6].

From the perspective of low carbon capacity, the maximum value in the matrix is 0.345, according to the comprehensive level of low carbon capacity of the 2010 A. Among the indicators with low carbon capacity, the highest weight is the net profit margin of carbon assets, and its membership degree is at the middle level. Except for the membership degree of carbon asset turnover rate is good, the other memberships are in the middle and middle. The reason is that the low-carbon technical support of the

enterprise is not in place, the system related to carbon emission cost and revenue management is not perfect, and the overall low-carbon concept of the enterprise needs to be strengthened.

4. Countermeasures and recommendations

4.1. Incorporate low-carbon strategies into long-term corporate development plans

Carbon emission rights can be traded as assets or commodities, and if a company can improve energy efficiency and reduce greenhouse gas emissions in various ways, it will have excess emission rights to sell, thereby bringing benefits to the enterprise. The low-carbon technology and low-carbon products formed in the company can also become the core competitiveness of the company and win opportunities for opening up new markets [7]. Low-carbon innovation should be followed as a normalization system, and companies should integrate low-carbon strategies into their daily management and production operations. Enterprises should review the situation, seize the strategic opportunity period, apply the clean development mechanism to enterprise management and product renewal, comprehensively enhance their own competitiveness, expand product market share, and upgrade enterprises from three aspects: efficient operation, product potential and public influence. Performance.

4.2. Improve accounting standards and build a unified standard for carbon information evaluation

Due to the lack of uniform standards, the disclosures of different companies are also different, which reduces the comparability of information. Although the “Interim Provisions on Accounting Treatment for Carbon Emissions Trading Pilots (Draft for Comment)” issued by the Ministry of Finance in September 2016 stipulated the disclosure content and disclosure carrier of carbon emission related information, it is still in the discussion stage and does not have basic the general guidance of accounting standards. Accelerating the formulation of relevant standards will promote the popularization of corporate carbon information disclosure behavior, enhance the normative and comparable nature of the disclosed information, and be conducive to the development of China's carbon accounting theory and practice.

5. Conclusion

From the perspective of low-carbon accounting, this paper makes a preliminary exploration of the establishment of corporate financial indicator system, introduces corporate environmental financial performance indicators, and establishes a financial indicator system combining static indicators and dynamic indicators. And a new way of thinking to explore the comprehensive evaluation of corporate financial performance. Due to the limitations of various aspects, further research is needed on the improvement of the indicator system, the acquisition of indicator data and the empirical analysis of analytical methods.

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